



**Formerly Used Defense Site  
Marion Engineer Depot  
Marion, Ohio**

**Industrial Worker Risk Scenario  
Addendum to the River Valley School  
Property Operable Unit 1 – Former  
Disposal Area Remedial Investigation  
Report**

*Prepared for:*

***U.S. Army Corps of Engineers  
Louisville District  
Louisville, Kentucky***

**Total Environmental Restoration Contract  
DACW27-97-D-0015 Task Order 0005**

January 2002



T.D. Final Report  
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**FORMERLY USED DEFENSE SITE  
MARION ENGINEER DEPOT  
MARION, OHIO**

**INDUSTRIAL WORKER RISK SCENARIO ADDENDUM  
TO THERIVER VALLEY SCHOOL PROPERTY  
OPERABLE UNIT 1 – FORMER DISPOSAL AREA  
REMEDIAL INVESTIGATION REPORT**

**January 2002**

**Prepared For:  
United States Army Corps of Engineers  
Louisville, Kentucky**

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**Prepared By:  
Montgomery Watson  
Novi, Michigan**

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TO THE RIVER VALLEY SCHOOL PROPERTY  
OPERABLE UNIT 1 – FORMER DISPOSAL AREA  
REMEDIAL INVESTIGATION REPORT**

**Contract DACW27-97-D0015  
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**Prepared for:**

**United States Army Corps of Engineers  
Louisville, Kentucky**

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Montgomery Watson certifies that, to the best of its knowledge and belief, the technical data delivered herewith under contract DACW27-97-D0015-0005 is complete, accurate, and complies with all requirements of the contract.

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**INDUSTRIAL RISK SCENARIO ADDENDUM TO THE RIVER VALLEY  
SCHOOL PROPERTY, OPERABLE UNIT 1 – FORMER DISPOSAL AREA  
REMEDIAL INVESTIGATION REPORT**

**INTRODUCTION**

The Baseline Risk Assessment performed for Operable Unit 1 (OU1) of the former Marion Engineer Depot addressed both current and potential future health risks associated with hazardous constituents at the OU1 property (Montgomery Watson, 2001). The risk assessment assumed that the property would continue to be used as a school, or possibly as residential housing. However, a Memorandum of Understanding (MOU) between the Ohio Environmental Protection Agency, the Army, and River Valley Local School District (RVLSD), indicates that the property will be used for different purposes in the future.

The MOU stated that the three parties agreed “that future use of the property will be limited to industrial/commercial use,” and that “clean up criteria will be risk based consistent with the industrial/commercial future use restriction.” In addition, RVLSD agreed to relocate all of its operations, including the schools and related facilities, by fall of 2003.

This addendum addresses potential health risks from future exposure to hazardous constituents at the OU1 property under the industrial/commercial land use. In addition, this addendum reiterates the risks associated with the use of the property as a school, based on the use of the property as a school until the fall of 2003. This addendum includes an exposure assessment and a risk characterization. The risk characterization includes an estimate of risks, and develops remediation goals (consistent with the MOU). As an addendum, basic information about the site and risk assessment methodology is not repeated.

**Exposure Assessment**

As stated in the introduction, this addendum addresses exposure by potential future industrial/commercial workers. Workers are assumed to come in contact with surficial soil through incidental ingestion, dermal contact, and inhalation of dust and vapors.

Within the Baseline Risk Assessment, a multitude of potential receptor populations were considered which could have potential for exposure. However, the approach in risk assessments is to select those groups that would represent reasonably maximum exposed (RME) receptor groups because of the nature of their activities. By assessing the potential level of exposure and risk for these RME receptor groups, the other receptor groups with lesser levels of exposure are therefore considered. The Baseline Risk Assessment identified the ballplayer (as a recreational user) as the receptor that would have the greatest potential exposure among all receptors that are currently present at the school (Montgomery Watson, 2001). Potential risks associated with the recreational user

(ballplayer) are reiterated in this Addendum so as to account for exposures that may occur up until the school is moved in the fall of 2003.

The equations used to estimate exposure were as follows:

#### Incidental Ingestion of Contaminants in Soil

$$\text{Intake (mg/kg-day)} = \frac{\text{CS} \times \text{IngR} \times \text{CF} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

where:

CS = Contaminant concentration in soil (mg/kg)

IngR = Ingestion rate (mg soil/day)

CF = Conversion factor ( $10^{-6}$  kg/mg)

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

BW = Body weight (kg)

AT = Averaging time (period over which exposure is averaged - days).

#### Dermal Contact With Contaminants in Soil

$$\text{Absorbed Dose (mg/kg-day)} = \frac{\text{CS} \times \text{CF} \times \text{SA} \times \text{AF} \times \text{ABS} \times \text{EF} \times \text{ED}}{\text{BW} \times \text{AT}}$$

where:

CS = Contaminant concentration in soil (mg/kg)

CF = Conversion factor ( $10^{-6}$  kg/mg)

SA = Skin surface area available for contact ( $\text{cm}^2/\text{event}$ )

AF = Adherence factor of soil ( $\text{mg}/\text{cm}^2\text{-day}$ )

ABS = Skin absorption factor (unitless)

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

BW = Body weight (kg)

AT = Averaging time (period over which exposure is averaged - days).

#### Inhalation of Fugitive Soil Emissions

$$\text{Intake (mg/kg-day)} = \frac{\text{CS} \times \text{InhR} \times \text{EF} \times \text{ED} \times (1/\text{PEF} + 1/\text{VF})}{\text{BW} \times \text{AT}}$$

where:

CS = Contaminant concentration in soil (mg/kg)

InhR = Inhalation rate ( $\text{m}^3/\text{day}$ )

CF = Conversion factor ( $10^{-6}$  kg/mg)

EF = Exposure frequency (days/year)

ED = Exposure duration (years)

PEF = Particulate emission factor ( $\text{m}^3/\text{kg}$ )

VF = Volatilization factor ( $\text{m}^3/\text{kg}$ )

EW = Body weight (kg)

AT = Averaging time (period over which exposure is averaged - days).

The RME parameters values are summarized in Table 1 and are discussed below for the worker. Table 2 summarizes parameters for a central tendency exposure (CTE) estimate. Parameter values for the recreational user (ballplayer) were discussed in Section 6.4.4 of the Baseline Risk Assessment (Montgomery Watson, 2001).

In an RME scenario, workers were assumed to work 250 days per year for 25 years. These values are the U.S. Environmental Protection Agency's (USEPA's) default values for these parameters. For evaluating a CTE scenario, workers were assumed to work for 219 days per year for 6.6 years. The CTE exposure frequency is based on data from the Bureau of Labor Statistics, while the CTE exposure duration is based on data for the median length of time a person spends at a given occupation (USEPA, 1993; 1997a,b,c).

The RME and CTE estimate of *body weight* for workers is 70 kilograms (154 pounds), which is the USEPA-recommended default value for this parameter. The USEPA recommends that the average body weight be used for both RME and central tendency exposure scenarios (USEPA, 1989). The rationale is that body weight correlates with other variables (e.g., skin surface area and inhalation rate), and that keeping body weight constant minimizes error from this dependence. Using an RME value for intake in combination with an average body weight is believed to result in an overall RME exposure estimate.

The USEPA's recommended *soil ingestion rate* for an adult is 100 mg/day. It was assumed that a worker experienced half of their soil ingestion on the job, or 50 mg/day. This is a default value in USEPA's *Supplemental Guidance to Risk Assessment Guidance for Superfund (RAGS)* (USEPA, 1991a). This value was used for both the RME and CTE.

Additional parameters needed to assess the dermal exposure scenario include the area of exposed skin, the amount of soil adhering to the skin, and the amount of chemical absorbed through the skin from soil. For workers, the RME and central tendency *skin surface area* was assumed to equal  $5,700 \text{ cm}^2$ , which is the default value for adults in the soon-to-be-released dermal guidance provided in advance to Montgomery Watson by USEPA. This information was provided in Appendix P of the Baseline Risk Assessment (Montgomery Watson, 2001). Ohio EPA risk assessors concurred with the use of this

dermal guidance from USEPA (personal communication, meeting with L. Moore and D. McClure, Ohio EPA, January 27, 2000)

The *soil-to-skin adherence factor* is the amount of soil that adheres to a square centimeter of skin. These values have been measured for different activities. A value of 0.07 mg/cm<sup>2</sup> was selected as the RME for a worker. This value is for a gardener, and reflects an average value for an activity that results in more soil adherence than is typical for general activities. A CTE value of 0.01 mg/cm<sup>2</sup> was established based on 50<sup>th</sup> percentile data for groundskeepers.

The amount of chemical that is absorbed through the skin into the body from soil is needed to estimate the dose resulting from dermal exposures to soil. This parameter is termed the *fraction of dermal absorption*, and is chemical-specific. Values have been established by USEPA in their soon-to-be-released dermal guidance, and provided in advance to Montgomery Watson by USEPA. The values used are the same as those used in the Baseline Risk Assessment.

To evaluate exposure via inhalation of dust and vapors, it is necessary to estimate the amount of air inhaled by the receptors. Inhalation rates have been provided in terms of the amount of air inhaled per hour in combination with the number of hours of exposure. The *inhalation rate* of an industrial/commercial worker was assumed to be equal to 2.5 m<sup>3</sup> per hour for the RME, and 1.5 m<sup>3</sup> per hour for the CTE. The RME inhalation rate corresponds to heavy activity, while the CTE value corresponds to moderate activity (USEPA, 1997a,b,c). The worker was assumed to have an 8-hour work day by convention for both the RME and CTE.

Also required to estimate the amount of inhalation exposure is the amount of dust or vapor in the air. For dust, USEPA recommends the calculation of a ratio between the concentration of the constituent in soil, and the concentration of the dust in air. This ratio is called the particulate emission factor, or PEF. The value of  $4.63 \times 10^9$  m<sup>3</sup>/kg was used for the industrial/commercial worker is the USEPA default value for this parameter (USEPA, 1991a).

For vapors, USEPA recommends the calculation of a ratio between the concentration of the constituent in soil and its concentration in air (USEPA, 1996). This ratio is called the volatilization factor, or VF. Values of VF have been calculated as shown in Table 6-12 of the Baseline Risk Assessment, and are chemical specific (Montgomery Watson, 2001). They are presented in Appendices R and S of that document. Volatilization factors are only developed for volatile organic compounds (VOCs).

#### **Risk Characterization and Remediation Goals**

The cancer risks and hazard indices for the industrial/commercial worker and the recreational user (ballplayer) are summarized in Table 3. Included in this table are cancer risk and hazard index estimates under RME and CTE scenarios for each receptor. Also

included are the cancer risks and hazard indices that would result from using the maximum detected concentrations of each constituent in soil, using RME assumptions.

The estimated cancer risk for a future worker exposed to constituents in surface soil under an RME scenario is  $1\text{E-}05$ , and the hazard index is 0.05. For a ballplayer, the estimated cancer risk and hazard index are  $4\text{E-}06$  and 0.08, respectively. The cancer risks for both receptors are above the point of departure of  $1\text{E-}06$  that has been identified by USEPA (USEPA, 1990). The hazard indices are below 1, indicating that there is no expectation of adverse effects for non-carcinogenic endpoints.

For the CTE exposure scenarios, the estimated cancer risk was  $1\text{E-}06$  and the hazard index was 0.02 for an industrial/commercial worker. For a recreational user (ballplayer), these values were  $2\text{E-}06$  and 0.04, respectively. The CTE cancer risk is just above the point of departure for a ballplayer, but not for the industrial/commercial worker. The hazard indices are in a range where no adverse effects are expected. Detailed calculation results for the RME and CTE scenarios are provided in Tables 4 – 7 for a worker. The comparable tables for a recreational user (ballplayer) are provided in Tables R5 – R6 and S5 – S6 for the RME and CTE scenarios, respectively, of the Baseline Risk Assessment (Montgomery Watson, 2001).

Using the maximum detected concentrations and RME exposure parameters, the estimated cancer risk is  $5\text{E-}04$  for an industrial/commercial worker and  $2\text{E-}04$  for a recreational user (ballplayer). These results are above both USEPA's point of departure of  $1\text{E-}06$ , as well as outside the potentially acceptable cancer risk range of  $1\text{E-}04$  to  $1\text{E-}06$  (USEPA, 1990). However, since these results are based on maximum detected concentrations which occur in different parts of the site for different compounds, they do not correspond to any real exposure scenario. The hazard indices were 0.2 for the industrial/commercial worker, and 0.3 for the ballplayer. Both of these values are below 1. Tables 8 and 9 provide the calculation details for an industrial/commercial worker; comparable tables for the recreation user (ballplayer) are T-5 and T-6 of the Baseline Risk Assessment (Montgomery Watson, 2001).

Also derived were remediation goals for each individual compound detected. Separate remediation goals were first derived based on the individual RME scenarios, corresponding to a hazard quotient of 1 and a cancer risk of  $1\text{E-}06$ . These concentrations were derived for both the industrial/commercial worker and the recreational user (ballplayer). The lowest of these four concentrations is the overall remediation goal. Furthermore, remediation goals were derived for compounds detected to a depth of 13 feet below ground surface (bgs). This was done as a contingency in order to have protective concentrations developed for any constituents with a reasonable potential to be detected during remediation.

The equations used to determine the concentration corresponding to a cancer risk of  $1\text{E-}06$  and a hazard quotient of 1 were:



$$RBRG_c = \frac{TCR \times BW \times AT_c}{EF \times ED \times \left[ (IngR \times CF \times SF_o) + (SA \times AF \times ABS \times CF \times SF_d) + (InhR \times ET \times \left( \frac{1}{VF} + \frac{1}{PEF} \right) \times SF_i) \right]}$$

$$RBRG_{nc} = \frac{THI \times BW \times AT_{nc}}{EF \times ED \times \left[ \left( \frac{IngR \times CF}{RfD_c} \right) + \left( \frac{SA \times AF \times ABS \times CF}{RfD_d} \right) + \frac{(InhR \times ET \times \left( \frac{1}{VF} + \frac{1}{PEF} \right))}{RfD_i} \right]}$$

where:

RBRG<sub>c</sub> = Risk-based remediation goal for carcinogenic effects in soil (ng/kg)  
 RBRG<sub>nc</sub> = Risk-based remediation goal for non-carcinogenic effects in soil (mg/kg)  
 TCR = Target cancer risk (unitless)  
 THI = Target hazard index (unitless)  
 BW = Body weight (kg)  
 AT<sub>c</sub> = Averaging time for carcinogenic effects (days).  
 EF = Exposure frequency (days/year)  
 ED = Exposure duration (years)  
 IngR = ingestion rate (mg soil/day)  
 CF = Conversion factor (10<sup>-6</sup> kg/mg)  
 SF<sub>o</sub> = Oral slope factor  
 RfD<sub>o</sub> = Oral reference dose  
 SA = Skin surface area available for contact (cm<sup>2</sup>/event)  
 AF = Adherence factor of soil (mg/cm<sup>2</sup>-day)  
 ABS = Skin absorption factor (unitless)  
 SF<sub>d</sub> = Dermal slope factor  
 RfD<sub>d</sub> = Dermal reference dose  
 InhR = Inhalation rate (m<sup>3</sup>/hr)  
 ET = Exposure time (hrs/day)  
 PEF = Particulate emission factor (m<sup>3</sup>/kg)  
 VF = Volatilization factor (m<sup>3</sup>/kg)  
 SF<sub>i</sub> = Inhalation slope factor  
 RfD<sub>i</sub> = Inhalation reference dose

With the exception of the TCR and THI, these parameters have previously been discussed (the slope factors and reference doses were discussed in the Baseline Risk Assessment, and the other parameters have been discussed in this Addendum). The TCR has been set to the USEPA point of departure of 1E-06, and the THI has been set to 1.0. The resulting RBRGs are shown in Table 10.

## REFERENCES

- Montgomery Watson, 2001. *Draft Final Remedial Investigation Report, Operable Unit 1 – Former Disposal Area, River Valley School Property, Marion, Ohio*. April, 2001.
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- U.S. Environmental Protection Agency (USEPA), 1995. *Soil Screening Guidance Technical Background Document*.
- U.S. Environmental Protection Agency (USEPA), 1997a. *Exposure Factors Handbook Volume I - General Factors*, Office of Research and Development, Washington, D.C., EPA/600/P-95/002Fa.
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- U.S. Environmental Protection Agency (USEPA), 1997c. *Exposure Factors Handbook Volume III - Activity Factors*, Office of Research and Development, Washington, D.C., EPA/600/P-95/002Fc.

## **TABLES**

**Table 1**

**Exposure Factors Used for the Calculation of Exposure Estimates - Reasonable Maximum Exposure Scenarios**

**Operable Unit 1 - Former Disposal Area  
River Valley School  
Marion, Ohio**

Parameter	Units	Industrial/ Commercial Worker		Recreational User (ballplayer)	
<b><u>General Parameters (g)</u></b>					
Exposure Frequency	days/year	250	(g1)	140	(g2)
Body Weight	kg	70	(g3)	59	(g4)
Exposure Duration	years	25	(g5)	6	(g6)
Averaging Time, Non-Carcinogenic Effects	days	9125	(g7)	2190	(g7)
Averaging Time, Carcinogenic Effects	days	25550	(g8)	25550	(g8)
<b><u>Soil Ingestion Parameters (s)</u></b>					
Soil Ingestion Rate	mg/day	50	(s1)	200	(s2)
Units Conversion Factor	kg/mg	0.000001		0.000001	
<b><u>Soil Dermal Exposure Parameters (d)</u></b>					
Skin Surface Area	cm <sup>2</sup>	5700	(d1)	5700	(d1)
Soil Adherence Factor	mg/cm <sup>2</sup>	0.07	(d2)	0.1	(d2)
Dermal Absorbance	unitless	chemical specific	(d4)	chemical specific	(d4)
Units Conversion Factor	kg/mg	0.000001		0.000001	
<b><u>Inhalation Parameters (i)</u></b>					
Inhalation Rate	m <sup>3</sup> /hr	2.5 m <sup>3</sup> /hr	(i1)	3.3 m <sup>3</sup> /hr	(i2)
Exposure Time	hrs/day	8	(i3)	3.1	(i4)
Particulate Emission Factor	m <sup>3</sup> /kg	4.63E+09	(i5)	4.63E+09	(i5)
Volatilization Factor	m <sup>3</sup> /kg	chemical specific	(i6)	chemical specific	(i6)

Footnotes:

- g1. Supplemental Guidance to Risk Assessment Guidance for Superfund (RAGS) used to represent the reasonable maximum exposure (RME) (U.S. EPA, 1991a).
- g2. Based on the activity survey (see Appendix Q of the Baseline Risk Assessment), a player may participate in both a school league (70 days/year, 3 hrs/day), and summer ball (70 days/year, 3 hrs/day) for a total of 140 days per year. It was assumed that the approximately 20 days per year when the student would use the ball fields within Operable Unit 1 (OU1) for physical education overlapped with the school league.
- g3. Within the Exposure Factors Handbook (U.S. EPA, 1997) a 71.8 kg body weight is recommended; however, since many of the toxicity values were developed using the assumption of a 70 kg body weight, the 70 kg body weight was used by convention.
- g4. Average body weight of adolescent children ages 13 -18 years derived from data presented in Table 7-3 of the Exposure Factors Handbook (U.S. EPA, 1997; see far right hand column of table labeled "Boys and Girls").
- g5. This value is the average of the lifelong tenure at an occupation recommended for men (30.1) and women (18.8) over the age of 70 (see Section 15.4.2 Recommendations: Occupational Mobility in the Exposure Factors Handbook (U.S. EPA, 1997)).
- g6. Assumes conservatively that a player plays ball throughout junior high and high school at River Valley Schools (i.e., 6 years).
- g7. By convention the noncarcinogenic averaging time is equal to the exposure duration in units of days.
- g8. By convention the averaging time for carcinogenic effects is set at a 70 year lifetime in units of days.
- s1. Supplemental Guidance to Risk Assessment Guidance for Superfund (RAGS) used to represent the RME (U.S. EPA, 1991a).
- s2. The soil ingestion rate is the recommended conservative estimate of the mean value for children presented in Table 4-23 of the Exposure Factors Handbook (U.S. EPA, 1997).
- d1. The skin surface area estimates are defaults for adult residents provided by U.S. EPA in a early release of the final dermal risk assessment guidance to be formally issued soon (see Appendix P of the Baseline Risk Assessment, which was provided by Dr. Mark Johnson of U.S. EPA on January 5, 2000). The worker was assumed to be primarily an indoor worker whose attire might be more similar to a resident, and would have more skin exposed than an outdoor worker. The surface area estimate for adult residents was also used as a conservative estimate for an adolescent's skin surface area for the ball player scenario.
- d2. The soil adherence value is a default for a resident that might engage in gardening, and was provided by Dr. Mark Johnson of the U.S. EPA in an early release of the final dermal risk assessment guidance to be formally issued soon (see Appendix P of the baseline risk assessment). Also refer to Appendix P for more details concerning how these adherence factors were developed. Note that the value for industrial workers in this appendix was developed with construction workers in mind. Construction workers have a great deal more contact with soil than normal commercial/industrial workers, and have been separately evaluated within the Baseline Risk Assessment.
- d3. Consistent with U.S. EPA guidance (U.S. EPA, 1997 and Appendix P of the baseline risk assessment), a soil adherence value (AF) for a reasonable worst case activity that would reflect similar soil contact for ball playing was selected, since no recommended default adherence value is available for the recreational use scenario. For purposes of this assessment, the 50th percentile AF for rugby players was selected, because it reflects a value that would reasonably represent an RME for the "baseball or softball-like" activities presented in the soon to be released final dermal guidance from U.S. EPA (refer to Appendix P of the Baseline Risk Assessment, Exhibit 3.3). Those activities that were considered "baseball or softball-like" were soccer and rugby. Soccer has been used to represent the central tendency.
- d4. Chemical specific; refer to Table 6-2 of the Baseline Risk Assessment. Values represent defaults provided by U.S. EPA where available from Appendix P.
- i1. Represents the recommended mean inhalation rate for outdoor workers performing heavy activities (see Table 5-23 within U.S. EPA, 1997).
- i2. Represents the recommended upper percentile (99th) inhalation rate for outdoor workers (includes athletes) from Table 5-23 within U.S. EPA, 1997. Used as an RME inhalation rate for athletes, because this value more conservatively reflects the potential upper limit of the inhalation rates athletes may have during an intense practice/ ball game that occurs over a relatively short duration.
- i3. An eight-hour work day is assumed by convention for workers.
- i4. Based on the activity survey (see Appendix Q of the Baseline Risk Assessment), ball players are assumed to have PE for 1 hr/day for 20 days/year using the ball fields at OU1; have baseball practices and games for the school team (70 days/year), and baseball practices and games for summer league (70 days/year) for 3 hrs/day. This equates to a time weighted average of 3.1 hrs/day over the 140 day exposure duration (i.e., [(1\*20) +(3 \*70) +(3\*70)]/140 = 3.1). Note it is assumed that PE class and ball playing activities for students overlap one another in terms of time and place.

- i5. The particulate emission factor (PEF) corresponds to the default value recommended by U.S. EPA in RAGS Part B (U.S. EPA, 1991b).
- i6. The volatilization factors (VFs) are chemical specific; refer to exposure tables in Appendices R and S of the Baseline Risk Assessment for these values. The VFs were derived using procedures in the U.S. EPA Soil Screening Guidance Technical Document (U.S. EPA, 1996). The specific parameters used to calculate each chemical specific VF can be found in Table 6-12 of the Baseline Risk Assessment.

**Table 2**

**Exposure Factors Used for the Calculation of Exposure Estimates - Central Tendency Exposure Scenarios**

**Operable Unit 1 - Former Disposal Area  
River Valley School  
Marion, Ohio**

Parameter	Units	Industrial/ Commercial Worker		Recreational User (ballplayer)	
<b><u>General Parameters (g)</u></b>					
Exposure Frequency	days/year	219	(g1)	140	(g2)
Body Weight	kg	70	(g3)	59	(g4)
Exposure Duration	years	6.6	(g5)	6	(g6)
Averaging Time, Non-Carcinogenic Effects	days	2409	(g7)	2190	(g7)
Averaging Time, Carcinogenic Effects	days	25550	(g8)	25550	(g8)
<b><u>Soil Ingestion Parameters (s)</u></b>					
Soil Ingestion Rate	mg/day	50	(s1)	100	(s2)
Units Conversion Factor	kg/mg	0.000001		0.000001	
<b><u>Soil Dermal Exposure Parameters (d)</u></b>					
Skin Surface Area	cm <sup>2</sup>	5700	(d1)	5700	(d1)
Soil Adherence Factor	mg/cm <sup>2</sup>	0.01	(d2)	0.04	(d2)
Dermal Absorbance	unitless	chemical specific	(d4)	chemical specific	(d4)
Units Conversion Factor	kg/mg	0.000001		0.000001	
<b><u>Inhalation Parameters (i)</u></b>					
Inhalation Rate	m <sup>3</sup> /hr	1.5	(i1)	1.3	(i2)
Exposure Time	hrs/day	8	(i3)	3.1	(i4)
Particulate Emission Factor	m <sup>3</sup> /kg	4.63E+09	(i5)	4.63E+09	(i5)
Volatilization Factor	m <sup>3</sup> /kg	chemical specific	(i6)	chemical specific	(i6)

Footnotes:

- g1. Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure, Draft (U.S. EPA, 1993).
- g2. Based on the activity survey (see Appendix Q of the Baseline Risk Assessment), a player may participate in both a school league (70 days/year, 3 hrs/day), and summer ball (70 days/year, 3 hrs/day) for a total of 140 days per year. It was assumed that the approximately 20 days per year when the student would use the ball fields within Operable Unit 1 (OU1) for physical education overlapped with the school league.
- g3. Within the Exposure Factors Handbook (U.S. EPA, 1997) a 71.8 kg body weight is recommended; however, since many of the toxicity values were developed using the assumption of a 70 kg body weight, the 70 kg body weight was used by convention.
- g4. Average body weight of adolescent children ages 13 -18 years derived from data presented in Table 7-3 of the Exposure Factors Handbook (U.S. EPA, 1997; see far right hand column of table labeled "Boys and Girls").
- g5. Represents the average of the lifelong tenure at an occupation recommended for a person 16 and over (see Table 15-176 of the Exposure Factors Handbook (U.S. EPA, 1997)).
- g6. Assumes conservatively that a player plays ball throughout junior high and high school at River Valley Schools (i.e., 6 years).
- g7. By convention the noncarcinogenic averaging time is equal to the exposure duration in units of days.
- g8. By convention the averaging time for carcinogenic effects is set at a 70 year lifetime in units of days.
- s1. Supplemental Guidance to Risk Assessment Guidance for Superfund (RAGS) used to represent the CTE (U.S. EPA, 1993).
- s2. The soil ingestion rate is the recommended recommended average value for children presented in Table 4-23 of the Exposure Factors Handbook (U.S. EPA, 1997).
- d1. The skin surface area estimates are defaults for adult residents provided by U.S. EPA in a early release of the final dermal risk assessment guidance to be formally issued soon (see Appendix P of the Baseline Risk Assessment, which was provided by Dr. Mark Johnson of U.S. EPA on January 5, 2000). The worker was assumed to be primarily an indoor worker whose attire might be more similar to a resident, and would have more skin exposed than an outdoor worker. The surface area estimate for adult residents was also used as a conservative estimate for an adolescent's skin surface area for the ball player scenario.
- d2. The soil adherence value is a default (central tendency) for a groundskeeper, and was provided by Dr. Mark Johnson of the U.S. EPA in an early release of the final dermal risk assessment guidance to be formally issued soon (see Appendix P of the baseline risk assessment). Also refer to Appendix P for more details concerning how these adherence factors were developed. Note that the value for industrial workers in this appendix was developed with construction workers in mind. Construction workers have a great deal more contact with soil than normal commercial/industrial workers, and have been separately evaluated within the Baseline Risk Assessment.
- d3. Consistent with U.S. EPA guidance (U.S. EPA, 1997 and Appendix P of the baseline risk assessment), a soil adherence value (AF) for a reasonable worst case activity that would reflect similar soil contact for ball playing was selected, since no recommended default adherence value is available for the recreational use scenario. For purposes of this assessment, the 50th percentile AF for soccer players was selected, because it reflects a value that would reasonably represent a central tendency for the "baseball or softball-like" activities presented in the soon to be released final dermal guidance from U.S. EPA (refer to Appendix P of the Baseline Risk Assessment, Exhibit 3-3). Those activities that were considered "baseball or softball-like" were soccer and rugby. Rugby has been used to represent an RME level of exposure.
- d4. Chemical specific; refer to Table 6-2 of the Baseline Risk Assessment
- i1. Represents the recommended mean inhalation rate for outdoor workers performing moderate activities (see Table 5-23 within U.S. EPA, 1997).
- i2. Represents the recommended hourly average inhalation rate for outdoor workers (includes athletes) from Table 5-23 within U.S. EPA, 1997
- i3. An eight-hour work day is assumed by convention for workers.
- i4. Based on the activity survey (see Appendix Q of the Baseline Risk Assessment), ball players are assumed to have PE for 1 hr/day for 20 days/year using the ball fields at OU1; have baseball practices and games for the school team (70 days/year), and baseball practices and games for summer league (70 days/year) for 3 hrs/day. This equates to a time weighted average of 3.1 hrs/day over the 140 day exposure duration (i.e.,  $[(1*20) + (3*70)]/140 = 3.1$ ). Note it is assumed that PE class and ball playing activities for students overlap one another in terms of time and place.
- i5. The particulate emission factor (PEF) corresponds to the default value recommended by U.S. EPA in RAGS Part B (U.S. EPA, 1991b).
- i6. The volatilization factors (VFs) are chemical specific; refer to exposure tables in Appendices R and S of the Baseline Risk Assessment for these values. The VFs were derived using procedures in the U.S. EPA Soil Screening Guidance Technical Document (U.S. EPA, 1996). The specific parameters used to calculate each chemical specific VF can be found in Table 6-12 of the Baseline Risk Assessment.



Table 3

## Summary of Health Risk Estimates

Operable Unit 1 - Former Disposal Area  
River Valley School  
Marion, Ohio

Hazard Index by Route						Cancer Risks By Route			
Receptor	EPC Type	Ingestion	Dermal	Inhalation	Total	Ingestion	Dermal	Inhalation	Total
Exposed Population: Industrial/Commercial Workers									
Worker	RME	2.00E-02	3.13E-02	4.78E-03	0.06	5.15E-06	4.9E-06	2.08E-08	1E-05
	CTE	1.76E-02	3.92E-03	9.79E-04	0.02	1.19E-06	1.2E-07	3.58E-09	1E-06
	Maximum	7.05E-02	1.01E-01	2.55E-02	0.2	2.51E-04	2.40E-04	1.08E-07	5E-04
Exposed Population: Recreational Users									
Ball Player	RME	5.33E-02	2.97E-02	1.35E-03	0.08	3.28E-06	1.05E-06	2.15E-09	4E-06
	CTE	2.66E-02	1.19E-02	5.30E-04	0.04	1.64E-06	4.8E-07	8.46E-10	2E-06
	Maximum	1.87E-01	9.58E-02	8.17E-03	0.29	1.60E-04	5.91E-05	1.31E-08	2E-04

CTE Central tendency exposure  
EPC Exposure point concentration  
RME Reasonable maximum exposure

AAG/vlr/MWK

[Mad1\_server1/jobs/1335/005/03/108/tables/ragsdrvs/master/RME Summ Risk Est. (Tbl 6-B).xls]

1335005.030107-MAD-1

Table 4

## Carcinogenic Exposure and Health Risk Estimates

Medium: Surface Soil  
LandUse: Current

Receptor: Industrial Worker-Adult  
Exposure Pathway: Incidental Ingestion, Dermal Contact, and  
Inhalation of Fugitive Dust/Vapors

Operable Unit 1 - Former Disposal Area  
River Valley School  
Marion, Ohio

CHEMICAL OF POTENTIAL CONCERN	EPC (mg/kg)	VF (Calculated)	Chronic Daily Intake Value			Slope Factors			Cancer Risks			Total Risks		
			Oral	mg/kg-day Dermal	Inhalation	Oral	kg-day/mg Dermal	Inhalation	Oral	Dermal	Inhalation	Total	% of Total	
Volatiles														
Chloroform	1.98E-03	3.23E+03	3.46E-10	2.76E-10	4.29E-08	6.10E-03	6.10E-03	8.10E-02	2.11E-12	1.68E-12	3.47E-09	3.48E-09	0.04	
1,2-Dichloroethene (cis)	5.80E-03	3.63E+03	1.01E-09	8.09E-10	1.12E-07	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
1,2-Dichloroethene (trans)	2.30E-03	2.26E+03	4.02E-10	3.21E-10	7.10E-08	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Methylene chloride	1.78E-02	2.74E+03	3.11E-09	2.48E-09	4.54E-07	7.50E-03	7.50E-03	1.65E-03	2.33E-11	1.86E-11	7.47E-10	7.89E-10	0.01	
Tetrachloroethene	2.20E-03	3.43E+03	3.84E-10	3.07E-10	4.48E-08	5.20E-02	5.20E-02	2.00E-03	2.00E-11	1.60E-11	8.95E-11	1.25E-10	0.00	
Toluene	2.30E-03	3.87E+03	4.02E-10	3.21E-10	4.16E-08	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Trichloroethene	6.50E-03	2.80E+03	1.14E-09	9.06E-10	1.67E-07	1.10E-02	1.10E-02	6.00E-03	1.25E-11	9.97E-12	9.74E-10	9.97E-10	0.01	
1,2,4-Trimethylbenzene	3.10E-03	4.51E+03	5.42E-10	4.32E-10	4.80E-08	NI	NI	NI	NI	NI	NI	0.00E+00	0.00	
SVOCs														
Acenaphthene	5.10E-01		8.91E-08	9.24E-08	7.70E-12	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Acenaphthylene	8.66E-01		1.51E-07	1.57E-07	1.31E-11	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Anthracene	1.05E+00		1.03E-07	1.90E-07	1.50E-11	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Benzo(a)anthracene	2.38E+00		4.16E-07	4.31E-07	3.59E-11	7.30E-01	7.30E-01	3.10E-01	3.04E-07	3.15E-07	1.11E-11	6.19E-07	6.34	
Benzo(a)pyrene	2.29E+00		4.00E-07	4.15E-07	3.46E-11	7.30E+00	7.30E+00	3.10E+00	2.92E-06	3.03E-06	1.07E-10	5.95E-06	60.98	
Benzo(b)fluoranthene	1.88E+00		3.28E-07	3.41E-07	2.84E-11	7.30E-01	7.30E-01	3.10E-01	2.40E-07	2.49E-07	8.80E-12	4.89E-07	5.01	
Benzo(g,h,i)perylene	7.04E-01		1.23E-07	1.28E-07	1.06E-11	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Benzo(k)fluoranthene	1.43E+00		2.50E-07	2.59E-07	2.16E-11	7.30E-02	7.30E-02	3.10E-02	1.82E-08	1.89E-08	6.69E-13	3.72E-08	0.38	
Butylbenzylphthalate	6.73E-01		1.18E-07	9.38E-08	1.02E-11	NI	NI	NI	NI	NI	NI	0.00E+00	0.00	
Carbazole	7.11E-01		1.24E-07	1.29E-07	1.07E-11	2.00E-02	2.00E-02	NI	2.48E-09	2.58E-09	NI	5.06E-09	0.05	
Chrysene	3.06E+00		5.35E-07	5.55E-07	4.62E-11	7.30E-03	7.30E-03	3.10E-03	3.90E-09	4.05E-09	1.43E-13	7.95E-09	0.08	
Dibenzofuran	4.85E-01		8.47E-08	8.79E-08	7.32E-12	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Dibenz(a,h)anthracene	4.46E-01		7.79E-08	8.08E-08	6.73E-12	7.30E+00	7.30E+00	3.10E+00	5.69E-07	5.90E-07	2.09E-11	1.16E-06	11.88	
Di-n-octyl Phthalate	8.80E-02		1.54E-08	1.23E-08	1.33E-12	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Fluoranthene	6.45E+00		1.13E-06	1.17E-06	9.74E-11	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Fluorene	6.44E-01		1.13E-07	1.17E-07	9.73E-12	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Indeno(1,2,3-cd)pyrene	9.20E-01		1.61E-07	1.67E-07	1.39E-11	7.30E-01	7.30E-01	3.10E-01	1.17E-07	1.22E-07	4.31E-12	2.39E-07	2.45	
2-Methylnaphthalene	2.95E-01		5.15E-08	5.34E-08	4.45E-12	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Naphthalene	4.13E-01		7.21E-08	7.48E-08	6.23E-12	NI	NI	NI	NI	NI	NI	0.00E+00	0.00	
Phenanthrene	3.64E+00		6.36E-07	6.60E-07	5.49E-11	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Phenol	1.58E-01		2.76E-08	2.20E-08	2.39E-12	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Pyrene	4.74E+00		8.28E-07	8.59E-07	7.16E-11	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
bis(2-ethylhexyl)phthalate	3.82E-01		6.67E-08	5.32E-08	5.76E-12	1.40E-02	1.40E-02	1.40E-02	9.34E-10	7.45E-10	8.07E-14	1.68E-09	0.02	

Table 4

## Carcinogenic Exposure and Health Risk Estimates

Medium: Surface Soil  
LandUse: Current

Receptor: Industrial Worker Adult  
Exposure Pathway: Incidental Ingestion, Dermal Contact, and  
Inhalation of Fugitive Dust/Vapors

Operable Unit 1 - Former Disposal Area  
River Valley School  
Marion, Ohio

CHEMICAL OF POTENTIAL CONCERN	EPC (mg/kg)	VF (Calculated)	Chronic Daily Intake Value			Slope Factors			Cancer Risks			Total Risks		
			Oral	Dermal	Inhalation	Oral	Dermal	Inhalation	Oral	Dermal	Inhalation	Total	% of Total	
Metals														
Antimony	6.60E+00		1.15E-06	9.20E-08	9.96E-11	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Barium	1.21E+02		2.11E-05	1.69E-06	1.83E-09	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Beryllium	6.80E-01		1.19E-07	9.48E-09	1.03E-11	NI	NI	8.40E+00	NI	NI	8.62E-11	8.62E-11	0.00	
Cadmium	6.80E-01		1.19E-07	9.48E-10	1.03E-11	NI	NI	6.30E+00	NI	NI	6.47E-11	6.47E-11	0.00	
Chromium VI	2.45E+01		4.28E-06	3.42E-07	3.70E-10	NI	NI	4.10E+01	NI	NI	1.52E-08	1.52E-08	0.16	
Cobalt	6.00E+00		1.71E-06	9.67E-08	1.04E-10	NI	NI	NI	NI	NI	NI	0.00E+00	0.00	
Copper	3.00E+01		5.24E-06	4.18E-07	4.53E-10	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Lead	6.70E+01		1.17E-05	9.34E-07	1.01E-09	NI	NI	NI	NI	NI	NI	0.00E+00	0.00	
Manganese	2.92E+02		5.10E-05	4.07E-06	4.41E-09	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Mercury	6.60E-02		1.15E-08	9.20E-10	9.96E-13	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Nickel	2.47E+01		4.32E-06	3.44E-07	3.73E-10	NI	NI	NI	NI	NI	NI	0.00E+00	0.00	
Silver	0.80E-01		1.19E-07	9.48E-09	1.03E-11	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Vanadium	2.28E+01		3.98E-06	3.18E-07	3.44E-10	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Zinc	1.22E+02		2.13E-05	1.70E-06	1.84E-09	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
PCBs														
Aroclor 1254	6.76E-02		1.18E-08	1.32E-08	1.02E-12	2.00E+00	2.00E+00	2.00E+00	2.36E-08	2.64E-08	2.04E-12	5.00E-08	0.51	
Aroclor 1260	2.77E-02		4.84E-09	5.41E-09	4.18E-13	2.00E+00	2.00E+00	2.00E+00	9.08E-09	1.08E-08	8.37E-13	2.03E-08	0.21	
Dioxins/Furans														
TCDD Equivalents	3.57E-05		6.24E-12	1.49E-12	5.39E-16	1.50E+05	1.50E+05	1.50E+05	9.36E-07	2.24E-07	8.08E-11	1.10E-06	11.88	
										Total Risk		9.8E-06		
Total Risk by Route										5.15E-06	4.59E-06	2.08E-08		

## Note:

1. The EPC for each analyte was calculated by using the 95 percentile upper confidence level (UCL).
2. Some metals have been screened out of the COPC list due to background concentrations exceeding maximum detected concentrations.
3. It should be noted that no 2,3,7,8-TCDD was detected at the site. However, the detected dioxin and dibenzofuran concentrations are converted to a 2,3,7,8-TCDD equivalent concentration by convention, because a toxicity value only exists for 2,3,7,8-TCDD.

Table 5

## Noncarcinogenic Exposure and Health Risk Estimates

Medium: Surface Soil  
Land Use: Current

Receptor: Industrial Worker-Adult  
Exposure Pathway: Incidental Ingestion, Dermal Contact, and  
Inhalation of Fugitive Dust/Vapors

Operable Unit 1 - Former Disposal Area  
River Valley School  
Marion, Ohio

CHEMICAL OF POTENTIAL CONCERN	EPC (mg/kg)	VF (Calculated)	Chronic Daily Intake Value			Reference Doses			Hazard Quotient			Hazard Index		
			Oral	mg/kg-day Dermal	Inhalation	Oral	mg/kg-day Dermal	Inhalation	Oral	Dermal	Inhalation	Total	% of Total	
VOLATILES														
Chloroform	1.98E-03	3228	9.69E-10	7.73E-10	1.20E-07	1.00E-02	1.00E-02	8.60E-05	9.69E-08	7.73E-08	1.40E-03	1.40E-03	0	
1,2-Dichloroethene (cis)	5.80E-03	3631	2.84E-09	2.26E-09	3.13E-07	1.00E-02	1.00E-02	NI	2.84E-07	2.26E-07	NI	5.10E-07	2	
1,2-Dichloroethene (trans)	2.30E-03	2265	1.13E-09	8.98E-10	1.99E-07	2.00E-02	2.00E-02	NI	5.63E-08	4.49E-08	NI	1.01E-07	0	
Methylene chloride	1.78E-02	2740	8.71E-09	6.95E-09	1.27E-06	6.00E-02	6.00E-02	8.57E-01	1.45E-07	1.16E-07	1.48E-06	1.74E-06	0	
Tetrachloroethene	2.20E-03	3435	1.08E-09	8.59E-10	1.25E-07	1.00E-02	1.00E-02	1.40E-01	1.08E-07	8.59E-08	8.95E-07	1.09E-06	0	
Toluene	2.30E-03	3866	1.13E-09	8.98E-10	1.16E-07	2.00E-01	2.00E-01	1.14E-01	5.63E-09	4.49E-09	1.02E-06	1.03E-06	0	
Trichloroethene	6.50E-03	2704	3.18E-09	2.54E-09	4.55E-07	6.00E-03	6.00E-03	NI	5.30E-07	4.23E-07	NI	9.53E-07	0	
1,2,4-Trimethylbenzene	3.10E-03	4510	1.52E-09	1.21E-09	1.35E-07	5.00E-02	5.00E-02	1.70E-03	3.03E-08	2.42E-08	7.91E-05	7.92E-05	0	
SVOCs														
Acenaphthene	5.10E-01		2.50E-07	2.59E-07	7.56E-11	6.00E-02	6.00E-02	NI	4.16E-06	4.31E-06	NI	8.47E-06	0	
Acenaphthylene	8.66E-01		4.24E-07	4.40E-07	1.28E-10	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Anthracene	1.05E+00		5.13E-07	5.37E-07	1.55E-10	3.00E-01	3.00E-01	NI	1.71E-06	1.77E-06	NI	3.48E-06	0	
Benzo(a)anthracene	2.38E+00		1.16E-06	1.21E-06	3.53E-10	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Benzo(a)pyrene	2.29E+00		1.12E-06	1.16E-06	3.40E-10	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Benzo(b)fluoranthene	1.88E+00		6.70E-07	6.84E-07	2.79E-10	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Benzo(g,h,i)perylene	7.04E-01		3.44E-07	3.57E-07	1.04E-10	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Benzo(k)fluoranthene	1.43E+00		7.00E-07	7.26E-07	2.12E-10	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Butylbenzylphthalate	6.73E-01		3.70E-07	3.63E-07	9.98E-11	2.00E-01	2.00E-01	NI	1.65E-06	1.31E-06	NI	2.96E-06	0	
Carbazole	7.11E-01		3.48E-07	3.61E-07	1.05E-10	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Chrysene	3.06E+00		1.50E-06	1.55E-06	4.54E-10	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Dibenzofuran	4.85E-01		2.37E-07	2.46E-07	7.19E-11	4.00E-03	4.00E-03	NI	5.93E-05	6.15E-05	NI	1.21E-04	0	
Dibenz(a,h)anthracene	4.46E-01		2.18E-07	2.26E-07	6.61E-11	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Di-n-octyl Phthalate	8.80E-02		4.31E-08	3.44E-08	1.30E-11	2.00E-02	2.00E-02	NI	2.15E-06	1.72E-06	NI	3.87E-06	0	
Fluoranthene	6.45E+00		3.16E-06	3.27E-06	9.56E-10	4.00E-02	4.00E-02	NI	7.89E-05	8.18E-05	NI	1.61E-04	0	
Fluorene	6.44E-01		3.15E-07	3.27E-07	9.55E-11	4.00E-02	4.00E-02	NI	7.88E-06	8.18E-06	NI	1.61E-05	0	
Indeno(1,2,3-cd)pyrene	9.20E-01		4.50E-07	4.67E-07	1.36E-10	NI	NI	NI	NI	NI	NI	0.00E+00	0	
2-Methylnaphthalene	2.95E-01		1.44E-07	1.50E-07	4.37E-11	2.00E-02	2.00E-02	NI	7.21E-06	7.48E-06	NI	1.47E-05	0	
Naphthalene	4.13E-01		2.02E-07	2.09E-07	6.12E-11	2.00E-02	2.00E-02	8.57E-04	1.01E-05	1.05E-05	7.14E-08	2.06E-05	0	
Phenanthrene	3.64E+00		1.78E-06	1.85E-06	5.40E-10	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Phenol	1.58E-01		7.73E-08	6.17E-08	2.34E-11	6.00E-01	6.00E-01	NI	1.29E-07	1.03E-07	NI	2.32E-07	0	
Pyrene	4.74E+00		2.32E-06	2.41E-06	7.03E-10	3.00E-02	3.00E-02	NI	7.73E-05	8.02E-05	NI	1.57E-04	0	
bis(2-ethylhexyl)phthalate	3.82E-01		1.87E-07	1.49E-07	5.66E-11	2.00E-02	2.00E-02	NI	9.34E-06	7.45E-06	NI	1.68E-05	0	

Table 5

## Noncarcinogenic Exposure and Health Risk Estimates

Medium: Surface Soil  
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Receptor: Industrial Worker-Adult  
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Operable Unit 1 - Former Disposal Area  
River Valley School  
Marion, Ohio

CHEMICAL OF POTENTIAL CONCERN	EPC (mg/kg)	VF (Calculated)	Chronic Daily Intake Value			Reference Doses			Hazard Quotient			Hazard Index	
			Oral	mg/kg-day Dermal	Inhalation	Oral	mg/kg-day Dermal	Inhalation	Oral	Dermal	Inhalation	Total	% of Total
<b>Metals</b>	0.00E+00												
Antimony	6.60E+00		3.23E-06	2.58E-07	9.78E-10	4.00E-04	6.00E-05	NI	8.07E-03	4.29E-03	NI	1.24E-02	0
Barium	1.21E+02		5.92E-05	4.72E-06	1.79E-08	7.00E-02	4.90E-03	1.40E-04	8.46E-04	9.64E-04	1.28E-04	1.94E-03	0
Beryllium	6.80E-01		3.33E-07	2.65E-08	1.01E-10	2.00E-03	1.40E-05	5.71E-06	1.66E-04	1.90E-03	1.76E-05	2.08E-03	3
Cadmium	6.80E-01		3.33E-07	2.65E-09	1.01E-10	1.00E-03	2.50E-05	5.70E-05	3.33E-04	1.00E-04	1.77E-06	4.41E-04	4
Chromium VI	2.45E+01		1.20E-05	9.57E-07	3.63E-09	3.00E-03	7.50E-05	2.86E-05	4.00E-03	1.28E-02	1.27E-04	1.69E-02	1
Cobalt	6.90E+00		3.38E-06	2.69E-07	1.02E-09	6.00E-02	6.00E-02	NI	5.63E-05	4.49E-06	NI	6.08E-05	30
Copper	3.00E+01		1.47E-05	1.17E-06	4.43E-09	3.70E-02	1.11E-02	NI	3.97E-04	1.00E-04	NI	3.02E-04	0
Lead	6.70E+01		3.28E-05	2.62E-06	9.93E-09	NI	NI	NI	NI	NI	NI	0.00E+00	1
Manganese	2.92E+02		1.43E-04	1.14E-05	4.33E-08	1.40E-01	5.60E-03	1.43E-05	1.02E-03	2.04E-03	3.03E-03	6.09E-03	0
Mercury	6.60E-02		3.23E-08	2.58E-09	9.78E-12	3.00E-04	3.00E-04	8.57E-05	1.08E-04	8.59E-06	1.14E-07	1.10E-04	11
Nickel	2.47E+01		1.21E-05	9.64E-07	3.66E-09	2.00E-02	8.00E-04	NI	6.04E-04	1.21E-03	NI	1.81E-03	0
Silver	6.80E-01		3.33E-07	2.65E-08	1.01E-10	5.00E-03	2.00E-04	NI	6.65E-05	1.33E-04	NI	1.99E-04	3
Vanadium	2.28E+01		1.12E-05	8.90E-07	3.58E-09	7.00E-03	1.82E-04	NI	1.39E-03	4.89E-03	NI	6.40E-03	0
Zinc	1.22E+02		5.97E-05	4.76E-06	1.81E-08	3.00E-01	3.00E-01	NI	1.99E-04	1.59E-05	NI	2.15E-04	12
<b>PCBs</b>													
Aroclor 1254	6.76E-02		3.31E-08	3.69E-08	1.00E-11	2.00E-05	2.00E-05	NI	1.65E-03	1.85E-03	NI	3.50E-03	0
Aroclor 1260	2.77E-02		1.36E-08	1.51E-08	4.11E-12	2.00E-05	2.00E-05	NI	6.78E-04	7.57E-04	NI	1.44E-03	6
<b>Dioxins/Furans</b>													
TCDD Equivalents	3.57E-05		1.75E-11	4.18E-12	5.29E-15	NI	NI	NI	NI	NI	NI	0.00E+00	0
<b>Total Hazard Index</b>												<b>5.6E-02</b>	
<b>Total Hazard Index by Route</b>												<b>2.00E-02</b>	<b>3.13E-02</b>
												<b>4.78E-03</b>	

## Note:

- The EPC for each analyte was calculated by using the 95 percentile upper confidence level (UCL).
- Some metals have been screened out of the COPC list due to background concentrations exceeding maximum detected concentrations.
- It should be noted that no 2,3,7,8-TCDD was detected at the site. However, the detected dioxin and dibenzofuran concentrations are converted to a 2,3,7,8-TCDD equivalent concentration by convention, because a toxicity value only exists for 2,3,7,8-TCDD.

AAG/JRM/MWK

Table 6

## Carcinogenic Exposure and Health Risk Estimates (Central Tendency)

Medium: Surface Soil  
Land Use: Current

Receptor: Industrial Worker-Adult  
Exposure Pathway: Incidental Ingestion, Dermal Contact, and  
Inhalation of Fugitive Dust/Vapors

Operable Unit 1 - Former Disposal Area  
River Valley School  
Marion, Ohio

CHEMICAL OF POTENTIAL CONCERN	EPC (mg/kg)	VF (Calculated)	Chronic Daily Intake Value			Slope Factors			Cancer Risks			Total Risks		
			Oral	mg/kg-day		Oral	kg-day/mg		Oral	Dermal	Inhalation	Total	% of Total	
				Dermal	Inhalation		Dermal	Inhalation						
Volatiles														
Chloroform	1.98E-03	1.66E+03	8.00E-11	9.12E-12	1.16E-08	6.10E-03	6.10E-03	8.10E-02	4.88E-13	5.56E-14	9.38E-10	9.38E-10	0.07	
1,2-Dichloroethene (cis)	5.80E-03	1.87E+03	2.34E-10	2.67E-11	3.01E-08	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
1,2-Dichloroethene (trans)	2.30E-03	1.16E+03	9.29E-11	1.06E-11	1.92E-08	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Methylene chloride	1.78E-02	1.41E+03	7.19E-10	8.20E-11	1.23E-07	7.50E-03	7.50E-03	1.65E-03	5.39E-12	6.15E-13	2.02E-10	2.08E-10	0.02	
Tetrachloroethene	2.20E-03	1.76E+03	8.89E-11	1.01E-11	1.21E-08	5.20E-02	5.20E-02	2.00E-03	4.62E-12	5.27E-13	2.42E-11	2.93E-11	0.00	
Toluene	2.30E-03	1.99E+03	9.29E-11	1.06E-11	1.12E-08	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Trichloroethene	6.50E-03	1.44E+03	2.63E-10	2.99E-11	4.38E-08	1.10E-02	1.10E-02	6.00E-03	2.89E-12	3.29E-13	2.63E-10	2.66E-10	0.02	
1,2,4-Trimethylbenzene	3.10E-03	2.32E+03	1.25E-10	1.43E-11	1.30E-08	NI	NI	NI	NI	NI	NI	0.00E+00	0.00	
SVOCs														
Acenaphthene	5.10E-01		2.06E-08	3.05E-09	1.07E-12	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Acenaphthylene	8.66E-01		3.50E-08	5.19E-09	1.81E-12	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Anthracene	1.02E+00		4.23E-08	6.20E-09	2.20E-12	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Benzo(a)anthracene	2.38E+00		9.62E-08	1.43E-08	4.99E-12	7.30E-01	7.30E-01	3.10E-01	7.02E-08	1.04E-08	1.55E-12	8.06E-08	5.99	
Benzo(a)pyrene	2.29E+00		9.25E-08	1.37E-08	4.80E-12	7.30E+00	7.30E+00	3.10E+00	6.76E-07	1.00E-07	1.49E-11	7.76E-07	57.66	
Benzo(b)fluoranthene	1.88E+00		1.00E-08	1.13E-08	5.94E-12	7.30E-01	7.30E-01	3.10E-01	5.55E-08	8.22E-09	1.22E-12	6.37E-08	4.73	
Benzo(g,h,i)perylene	7.04E-01		2.84E-08	4.22E-09	1.47E-12	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Benzo(k)fluoranthene	1.43E+00		5.78E-08	8.56E-09	3.00E-12	7.30E-02	7.30E-02	3.10E-02	4.22E-09	6.25E-10	9.29E-14	4.84E-09	0.36	
Butylbenzylphthalate	6.73E-01		2.72E-08	3.10E-09	1.41E-12	NI	NI	NI	NI	NI	NI	0.00E+00	0.00	
Carbazole	7.11E-01		2.87E-08	4.26E-09	1.49E-12	2.00E-02	2.00E-02	NI	5.75E-10	8.52E-11	NI	6.60E-10	0.05	
Chrysene	3.06E+00		1.24E-07	1.83E-08	6.41E-12	7.30E-03	7.30E-03	3.10E-03	9.03E-10	1.34E-10	1.99E-14	1.04E-09	0.08	
Dibenzofuran	4.85E-01		1.96E-08	2.90E-09	1.02E-12	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Dibenz(a,h)anthracene	4.46E-01		1.80E-08	2.67E-09	9.34E-13	7.30E+00	7.30E+00	3.10E+00	1.32E-07	1.95E-08	2.90E-12	1.51E-07	11.23	
Di-n-octyl Phthalate	8.80E-02		3.56E-09	4.05E-10	1.84E-13	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Fluoranthene	6.45E+00		2.61E-07	3.86E-08	1.35E-11	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Fluorene	6.44E-01		2.60E-08	3.86E-09	1.35E-12	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Indeno(1,2,3-cd)pyrene	9.20E-01		3.72E-08	5.51E-09	1.93E-12	7.30E-01	7.30E-01	3.10E-01	2.71E-08	4.02E-09	5.97E-13	3.12E-08	2.32	
2-Methylnaphthalene	2.95E-01		1.19E-08	1.76E-09	6.17E-13	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Naphthalene	4.13E-01		1.67E-08	2.47E-09	8.65E-13	NI	NI	NI	NI	NI	NI	0.00E+00	0.00	
Phenanthrene	3.64E+00		1.47E-07	2.18E-08	7.67E-12	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Phenol	1.58E-01		6.38E-09	7.28E-10	3.31E-13	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Pyrene	4.74E+00		1.92E-07	2.84E-08	9.93E-12	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
bis(2-ethylhexyl)phthalate	3.82E-01		1.54E-08	1.76E-09	8.00E-13	1.40E-02	1.40E-02	1.40E-02	2.16E-10	2.46E-11	1.12E-14	2.41E-10	0.02	

Table 6

## Carcinogenic Exposure and Health Risk Estimates (Central Tendency)

Medium: Surface Soil  
Land Use: Current

Receptor: Industrial Worker-Adult  
Exposure Pathway: Incidental Ingestion, Dermal Contact, and  
Inhalation of Fugitive Dust/Vapors

Operable Unit 1 - Former Disposal Area  
River Valley School  
Marion, Ohio

CHEMICAL OF POTENTIAL CONCERN	EPC (mg/kg)	VF (Calculated)	Chronic Daily Intake Value			Slope Factors			Cancer Risks			Total Risks		
			mg/kg-day			kg-day/mg			Oral	Dermal	Inhalation	Total	% of Total	
			Oral	Dermal	Inhalation	Oral	Dermal	Inhalation						
Metals														
Antimony	6.60E+00		2.67E-07	3.04E-09	1.38E-11	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Barium	1.21E+02		4.89E-06	5.57E-08	2.53E-10	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Beryllium	6.80E-01		2.75E-08	3.13E-10	1.42E-12	NI	NI	8.40E+00	NI	NI	1.20E-11	1.20E-11	0.00	
Cadmium	6.80E-01		2.75E-08	3.13E-11	1.42E-12	NI	NI	6.30E+00	NI	NI	8.97E-12	8.97E-12	0.00	
Chromium VI	2.45E+01		9.90E-07	1.13E-08	5.13E-11	NI	NI	4.10E+01	NI	NI	2.10E-09	2.10E-09	0.16	
Cobalt	6.90E+00		2.79E-07	3.18E-09	1.45E-11	NI	NI	NI	NI	NI	NI	0.00E+00	0.00	
Copper	3.00E+01		1.21E-06	1.38E-08	6.28E-11	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Lead	6.70E+01		2.71E-06	3.09E-08	1.40E-10	NI	NI	NI	NI	NI	NI	0.00E+00	0.00	
Manganese	2.92E+02		1.18E-05	1.33E-07	6.12E-10	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Mercury	6.60E-02		2.67E-09	3.04E-11	1.38E-13	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Nickel	2.47E+01		9.98E-07	1.14E-08	5.17E-11	NI	NI	NI	NI	NI	NI	0.00E+00	0.00	
Silver	6.80E-01		2.75E-08	3.13E-10	1.42E-12	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Vanadium	2.28E+01		9.21E-07	1.05E-08	4.78E-11	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Zinc	1.22E+02		4.93E-06	5.62E-08	2.56E-10	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
PCBs														
Aroclor 1254	6.76E-02		2.73E-09	4.36E-10	1.42E-13	2.00E+00	2.00E+00	2.00E+00	5.46E-09	8.72E-10	2.83E-13	6.34E-09	0.47	
Aroclor 1260	2.77E-02		1.12E-09	1.79E-10	5.80E-14	2.00E+00	2.00E+00	2.00E+00	2.24E-09	3.57E-10	1.16E-13	2.60E-09	0.19	
Dioxins/Furans														
TCDD Equivalents	3.57E-05		1.44E-12	4.93E-14	7.48E-17	1.50E+05	1.50E+05	1.50E+05	2.16E-07	7.40E-09	1.12E-11	2.24E-07	16.64	
Total Risk												1.3E-06		
Total Risk by Route									1.19E-06	1.52E-07	3.58E-09			

## Note:

- The EPC for each analyte was calculated by using the 95 percentile upper confidence level (UCL).
- Some metals have been screened out of the COPC list due to background concentrations exceeding maximum detected concentrations.
- It should be noted that no 2,3,7,8-TCDD was detected at the site. However, the detected dioxin and dibenzofuran concentrations are converted to a 2,3,7,8-TCDD equivalent concentration by convention, because a toxicity value only exists for 2,3,7,8-TCDD.

Table 7

## Noncarcinogenic Exposure and Health Risk Estimates (Central Tendency)

Medium: Surface Soil  
LandUse: Current

Receptor: Industrial Worker-Adult  
Exposure Pathway: Incidental Ingestion, Dermal Contact, and  
Inhalation of Fugitive Dust/Vapors

Operable Unit 1 - Former Disposal Area  
River Valley School  
Marion, Ohio

CHEMICAL OF POTENTIAL CONCERN	EPC (mg/kg)	VF (Calculated)	Chronic Daily Intake Value			Reference Doses			Hazard Quotient			Hazard Index		
			Oral	mg/kg-day Dermal	Inhalation	Oral	mg/kg-day Dermal	Inhalation	Oral	Dermal	Inhalation	Total	% of Total	
VOLATILES														
Chloroform	1.98E-03	1659	8.49E-10	9.67E-11	3.70E-08	1.00E-02	1.00E-02	8.60E-05	8.40E-08	9.67E-09	4.30E-04	4.30E-04	0	
1,2-Dichloroethene (cis)	5.80E-03	1866	2.49E-09	2.83E-10	9.64E-08	1.00E-02	1.00E-02	NI	2.49E-07	2.83E-08	NI	2.77E-07	2	
1,2-Dichloroethene (trans)	2.30E-03	1164	9.86E-10	1.12E-10	6.13E-08	2.00E-02	2.00E-02	NI	4.93E-08	5.62E-09	NI	5.49E-08	0	
Methylene chloride	1.78E-02	1408	7.63E-09	8.70E-10	3.92E-07	6.00E-02	6.00E-02	8.57E-01	1.77E-07	1.45E-08	4.57E-07	5.90E-07	0	
Tetrachloroethene	2.20E-03	1765	9.43E-10	1.07E-10	3.86E-08	1.00E-02	1.00E-02	1.40E-01	9.43E-08	1.07E-08	2.76E-07	3.81E-07	0	
Toluene	2.30E-03	1986	9.86E-10	1.12E-10	3.59E-08	2.00E-01	2.00E-01	1.14E-01	4.93E-09	5.62E-10	3.14E-07	3.20E-07	0	
Trichloroethene	6.50E-03	1438	2.70E-09	3.18E-10	1.40E-07	6.00E-03	6.00E-03	NI	4.64E-07	5.29E-08	NI	5.17E-07	0	
1,2,4-Trimethylbenzene	3.10E-03	2317	1.33E-09	1.51E-10	4.15E-08	5.00E-02	5.00E-02	1.70E-03	2.66E-08	3.03E-09	2.44E-05	2.44E-05	0	
SVOCs														
Acenaphthene	5.10E-01		2.19E-07	3.24E-08	1.20E-11	6.00E-02	6.00E-02	NI	3.64E-06	5.40E-07	NI	4.18E-06	0	
Acenaphthylene	8.66E-01		3.71E-07	5.50E-08	2.03E-11	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Anthracene	1.05E+00		4.40E-07	6.64E-08	2.46E-11	3.00E-01	3.00E-01	NI	1.50E-06	2.22E-07	NI	1.72E-06	0	
Benzo(a)anthracene	2.38E+00		1.02E-06	1.51E-07	5.59E-11	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Benzo(a)pyrene	2.29E+00		9.81E-07	1.45E-07	5.38E-11	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Benzo(b)fluoranthene	1.88E+00		8.06E-07	1.10E-07	4.41E-11	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Benzo(g,h,i)perylene	7.04E-01		3.02E-07	4.47E-08	1.65E-11	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Benzo(k)fluoranthene	1.43E+00		6.13E-07	9.08E-08	3.36E-11	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Butylbenzylphthalate	6.73E-01		2.88E-07	2.99E-08	1.58E-11	2.00E-01	2.00E-01	NI	1.44E-06	1.64E-07	NI	1.61E-06	0	
Carbazole	7.11E-01		3.05E-07	4.52E-08	1.67E-11	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Chrysene	3.06E+00		1.31E-06	1.94E-07	7.19E-11	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Dibenzofuran	4.85E-01		2.08E-07	3.08E-08	1.14E-11	4.00E-03	4.00E-03	NI	5.20E-05	7.70E-06	NI	5.97E-05	0	
Dibenz(a,h)anthracene	4.46E-01		1.91E-07	2.83E-08	1.05E-11	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Di-n-octyl Phthalate	8.80E-02		3.77E-08	4.30E-09	2.07E-12	2.00E-02	2.00E-02	NI	1.89E-06	2.15E-07	NI	2.10E-06	0	
Fluoranthene	6.45E+00		2.76E-06	4.10E-07	1.51E-10	4.00E-02	4.00E-02	NI	6.91E-05	1.02E-05	NI	7.93E-05	0	
Fluorene	6.44E-01		2.76E-07	4.09E-08	1.51E-11	4.00E-02	4.00E-02	NI	6.90E-06	1.02E-06	NI	7.93E-06	0	
Indeno(1,2,3-cd)pyrene	9.20E-01		3.94E-07	5.84E-08	2.16E-11	NI	NI	NI	NI	NI	NI	0.00E+00	0	
2-Methylnaphthalene	2.95E-01		1.26E-07	1.87E-08	6.92E-12	2.00E-02	2.00E-02	NI	6.32E-06	9.36E-07	NI	7.25E-06	0	
Naphthalene	4.13E-01		1.77E-07	2.62E-08	9.69E-12	2.00E-02	2.00E-02	8.57E-04	8.85E-06	1.31E-06	1.13E-08	1.02E-05	0	
Phenanthrene	3.64E+00		1.56E-06	2.31E-07	8.55E-11	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Phenol	1.58E-01		6.77E-08	7.72E-09	3.71E-12	6.00E-01	6.00E-01	NI	1.13E-07	1.29E-08	NI	1.26E-07	0	
Pyrene	4.74E+00		2.03E-06	3.01E-07	1.11E-10	3.00E-02	3.00E-02	NI	6.77E-05	1.00E-05	NI	7.77E-05	0	
bis(2-ethylhexyl)phthalate	3.82E-01		1.64E-07	1.87E-08	8.97E-12	2.00E-02	2.00E-02	NI	8.18E-06	9.33E-07	NI	9.12E-06	0	



Table 7

## Noncarcinogenic Exposure and Health Risk Estimates (Central Tendency)

Medium: Surface Soil  
LandUse: Current

Receptor: Industrial Worker-Adult  
Exposure Pathway: Incidental Ingestion, Dermal Contact, and  
Inhalation of Fugitive Dust/Vapors

Operable Unit 1 - Former Disposal Area  
River Valley School  
Marion, Ohio

CHEMICAL OF POTENTIAL CONCERN	EPC (mg/kg)	VF (Calculated)	Chronic Daily Intake Value			Reference Doses			Hazard Quotient			Hazard Index	
			Oral	mg/kg-day Dermal	Inhalation	Oral	mg/kg-day Dermal	Inhalation	Oral	Dermal	Inhalation	Total	% of Total
<b>Metals</b>	0.00E+00												
Antimony	6.60E+00		2.83E-06	3.22E-08	1.55E-10	4.00E-04	6.00E-05	NI	7.07E-03	5.37E-04	NI	7.61E-03	0
Barium	1.21E+02		5.19E-05	5.91E-07	2.84E-09	7.00E-02	4.90E-03	1.40E-04	7.41E-04	1.21E-04	2.03E-05	8.82E-04	0
Beryllium	6.80E-01		2.91E-07	3.32E-09	1.60E-11	2.00E-03	1.40E-05	5.71E-06	1.46E-04	2.37E-04	2.79E-06	3.86E-04	4
Cadmium	6.80E-01		2.91E-07	3.32E-10	1.60E-11	1.00E-03	2.50E-05	5.70E-05	2.91E-04	1.33E-05	2.80E-07	3.05E-04	2
Chromium VI	2.45E+01		1.05E-05	1.20E-07	5.75E-10	3.00E-03	7.50E-05	2.86E-05	3.50E-03	1.60E-03	2.01E-05	5.12E-03	1
Cobalt	6.90E+00		2.96E-06	3.37E-08	1.62E-10	6.00E-02	6.00E-02	NI	4.93E-05	5.62E-07	NI	4.98E-05	23
Copper	3.00E+01		1.29E-05	1.47E-07	7.05E-10	3.70E-02	1.11E-02	NI	3.47E-04	1.32E-05	NI	3.61E-04	0
Lead	6.70E+01		2.87E-05	3.27E-07	1.57E-09	NI	NI	NI	NI	NI	NI	0.00E+00	2
Manganese	2.92E+02		1.25E-04	1.43E-06	6.86E-09	1.40E-01	5.60E-03	1.43E-05	8.94E-04	2.55E-04	4.80E-04	1.63E-03	0
Mercury	6.60E-02		2.03E-08	3.22E-10	1.55E-12	3.00E-04	3.00E-04	8.57E-05	9.43E-05	1.07E-06	1.81E-08	9.54E-05	7
Nickel	2.47E+01		1.06E-05	1.21E-07	5.80E-10	2.00E-02	8.00E-04	NI	5.29E-04	1.51E-04	NI	6.80E-04	0
Silver	6.80E-01		2.91E-07	3.32E-09	1.60E-11	5.00E-03	2.00E-04	NI	5.83E-05	1.66E-05	NI	7.49E-05	3
Vanadium	2.28E+01		9.77E-06	1.11E-07	5.35E-10	7.00E-03	1.87E-04	NI	1.40E-03	6.12E-04	NI	2.01E-03	0
Zinc	1.22E+02		5.23E-05	5.96E-07	2.86E-09	3.00E-01	3.00E-01	NI	1.74E-04	1.99E-06	NI	1.76E-04	9
<b>PCBs</b>													
Aroclor 1254	6.76E-02		2.90E-08	4.62E-09	1.59E-12	2.00E-05	2.00E-05	NI	1.45E-03	2.31E-04	NI	1.68E-03	0
Aroclor 1260	2.77E-02		1.19E-08	1.90E-09	6.51E-13	2.00E-05	2.00E-05	NI	5.94E-04	9.48E-05	NI	6.89E-04	7
<b>Dioxins/Furans</b>						NI	NI	NI					
TCDD Equivalents	3.57E-05		1.53E-11	5.23E-13	8.38E-16	NI	NI	NI	NI	NI	NI	0.00E+00	0

Total Hazard Index 2.2E-02

Total Hazard Index by Route 1.76E-02 3.92E-03 9.79E-04

## Note:

- The EPC for each analyte was calculated by using the 95 percentile upper confidence level (UCL).
- Some metals have been screened out of the COPC list due to background concentrations exceeding maximum detected concentrations.
- It should be noted that no 2,3,7,8-TCDD was detected at the site. However, the detected dioxin and dibenzofuran concentrations are converted to a 2,3,7,8-TCDD equivalent concentration by convention, because a toxicity value only exists for 2,3,7,8-TCDD.

AAG/JRM/MWK

Table 8

## Carcinogenic Exposure and Health Risk Estimates (Maximum)

Medium: Surface Soil  
Land Use: Current

Receptor: Industrial Worker-Adult  
Exposure Pathway: Incidental Ingestion, Dermal Contact, and  
Inhalation of Fugitive Dust/Vapors

Operable Unit 1 - Former Disposal Area  
River Valley School  
Marion, Ohio

CHEMICAL OF POTENTIAL CONCERN	Maximum Concentration (mg/kg)	VF (Calculated)	Chronic Daily Intake Value			Slope Factors			Cancer Risks			Total Risks		
			mg/kg-day			kg-day/mg						Total	% of Total	
			Oral	Dermal	Inhalation	Oral	Dermal	Inhalation	Oral	Dermal	Inhalation			
Volatiles														
Chloroform	1.34E-02	3.23E+03	2.34E-09	1.87E-09	2.90E-07	6.10E-03	6.10E-03	8.10E-02	1.43E-11	1.14E-11	2.35E-08	2.35E-08	0.00	
1,2-Dichloroethene (cis)	1.92E+00	3.63E+03	3.35E-07	2.68E-07	3.70E-05	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
1,2-Dichloroethene (trans)	2.26E-02	2.26E+03	3.95E-09	3.15E-09	6.97E-07	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Methylene chloride	2.22E-01	2.74E+03	3.88E-08	3.10E-08	5.66E-06	7.50E-03	7.50E-03	1.65E-03	2.91E-10	2.32E-10	9.32E-09	9.84E-09	0.00	
Tetrachloroethene	1.45E-02	3.43E+03	2.53E-09	2.02E-09	2.95E-07	5.20E-02	5.20E-02	2.00E-03	1.32E-10	1.05E-10	5.90E-10	8.27E-10	0.00	
Toluene	2.10E-02	3.87E+03	3.67E-09	2.93E-09	3.80E-07	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Trichloroethene	1.13E-01	2.80E+03	1.97E-08	1.58E-08	2.82E-06	1.10E-02	1.10E-02	6.00E-03	2.17E-10	1.73E-10	1.69E-08	1.73E-08	0.00	
1,2,4-Trimethylbenzene	3.10E-03	4.51E+03	5.42E-10	4.32E-10	4.80E-08	NI	NI	NI	NI	NI	NI	0.00E+00	0.00	
SVOCs														
Acenaphthene	2.16E+01		3.77E-06	3.92E-06	3.26E-10	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Acenaphthylene	8.66E-01		1.51E-07	1.57E-07	1.31E-11	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Anthracene	3.33E+01		9.70E-06	1.01E-05	0.38E-10	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Benzo(a)anthracene	1.61E+02		2.81E-05	2.92E-05	2.43E-09	7.30E-01	7.30E-01	3.10E-01	2.05E-05	2.13E-05	7.53E-10	4.18E-05	8.19	
Benzo(a)pyrene	1.45E+02		2.53E-05	2.63E-05	2.19E-09	7.30E+00	7.30E+00	3.10E+00	1.85E-04	1.92E-04	6.79E-09	3.77E-04	73.79	
Benzo(b)fluoranthene	1.03E+02		1.80E-05	1.87E-05	1.33E-09	7.30E-01	7.30E-01	3.10E-01	1.31E-05	1.36E-05	4.82E-10	2.68E-05	5.74	
Benzo(g,h,i)perylene	3.35E+01		5.85E-06	6.07E-06	5.06E-10	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Benzo(k)fluoranthene	4.68E+01		8.18E-06	8.48E-06	7.06E-10	7.30E-02	7.30E-02	3.10E-02	5.97E-07	6.19E-07	2.19E-11	1.22E-06	0.24	
Butylbenzylphthalate	6.73E-01		1.18E-07	9.38E-08	1.02E-11	NI	NI	NI	NI	NI	NI	0.00E+00	0.00	
Carbazole	2.69E+01		4.70E-06	4.88E-06	4.06E-10	2.00E-02	2.00E-02	NI	9.40E-08	9.75E-08	NI	1.92E-07	0.04	
Chrysene	1.90E+02		3.32E-05	3.44E-05	2.87E-09	7.30E-03	7.30E-03	3.10E-03	2.42E-07	2.51E-07	8.89E-12	4.94E-07	0.10	
Dibenzofuran	1.14E+01		1.99E-06	2.07E-06	1.72E-10	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Dibenz(a,h)anthracene	1.96E+01		3.42E-06	3.55E-06	2.96E-10	7.30E+00	7.30E+00	3.10E+00	2.50E-05	2.59E-05	9.17E-10	5.09E-05	9.97	
Di-n-octyl Phthalate	8.80E-02		1.54E-08	1.23E-08	1.33E-12	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Fluoranthene	3.42E+02		5.98E-05	6.20E-05	5.16E-09	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Fluorene	2.40E+01		4.19E-06	4.35E-06	3.62E-10	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Indeno(1,2,3-cd)pyrene	4.17E+01		7.29E-06	7.56E-06	6.29E-10	7.30E-01	7.30E-01	3.10E-01	5.32E-06	5.52E-06	1.95E-10	1.08E-05	2.12	
2-Methylnaphthalene	2.17E+00		3.79E-07	3.93E-07	3.28E-11	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Naphthalene	7.14E+00		1.25E-06	1.29E-06	1.08E-10	NI	NI	NI	NI	NI	NI	0.00E+00	0.00	
Phenanthrene	2.32E+02		4.05E-05	4.21E-05	3.50E-09	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Phenol	1.58E-01		2.76E-08	2.20E-08	2.39E-12	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
Pyrene	3.42E+02		5.98E-05	6.20E-05	5.16E-09	NC	NC	NC	NI	NI	NI	0.00E+00	0.00	
bis(2-ethylhexyl)phthalate	1.31E+01		2.64E-06	2.11E-06	2.28E-10	1.40E-02	1.40E-02	1.40E-02	3.60E-08	2.95E-08	3.19E-12	6.64E-08	0.01	

Table 8

## Carcinogenic Exposure and Health Risk Estimates (Maximum)

Medium: Surface Soil  
LandUse: Current

Receptor: Industrial Worker-Adult  
Exposure Pathway: Incidental Ingestion, Dermal Contact, and  
Inhalation of Fugitive Dust/Vapors

Operable Unit 1 - Former Disposal Area  
River Valley School  
Marion, Ohio

CHEMICAL OF POTENTIAL CONCERN	Maximum Concentration (mg/kg)	VF (Calculated)	Chronic Daily Intake Value			Slope Factors			Cancer Risks			Total Risks	
			mg/kg-day			kg-day/mg						Total	% of Total
			Oral	Dermal	Inhalation	Oral	Dermal	Inhalation	Oral	Dermal	Inhalation		
<b>Metals</b>													
Antimony	1.50E+01		2.62E-06	2.09E-07	2.26E-10	NC	NC	NC	NI	NI	NI	0.00E+00	0.00
Barium	1.94E+02		3.39E-05	2.70E-06	2.93E-09	NC	NC	NC	NI	NI	NI	0.00E+00	0.00
Beryllium	1.65E+00		2.88E-07	2.30E-08	2.49E-11	NI	NI	8.40E+00	NI	NI	2.09E-10	2.09E-10	0.00
Cadmium	1.74E+00		3.04E-07	2.43E-09	2.63E-11	NI	NI	6.30E+00	NI	NI	1.65E-10	1.65E-10	0.00
Chromium VI	7.76E+01		1.36E-05	1.08E-06	1.17E-09	NI	NI	4.10E+01	NI	NI	4.80E-08	4.80E-08	0.01
Cobalt	2.53E+01		4.47E-06	3.53E-07	3.87E-10	NI	NI	NI	NI	NI	NI	0.00E+00	0.00
Copper	3.93E+02		6.87E-05	5.48E-06	5.93E-09	NC	NC	NC	NI	NI	NI	0.00E+00	0.00
Lead	4.66E+02		8.14E-05	6.50E-06	7.03E-09	NI	NI	NI	NI	NI	NI	0.00E+00	0.00
Manganese	1.47E+03		2.57E-04	2.05E-05	2.32E-08	NC	NC	NC	NI	NI	NI	0.00E+00	0.00
Mercury	1.40E-01		2.45E-08	1.95E-09	2.11E-12	NC	NC	NC	NI	NI	NI	0.00E+00	0.00
Nickel	4.54E+01		7.93E-06	6.33E-07	6.85E-10	NI	NI	NI	NI	NI	NI	0.00E+00	0.00
Silver	2.10E+00		4.72E-07	3.76E-08	4.00E-11	NC	NC	NC	NI	NI	NI	0.00E+00	0.00
Vanadium	3.41E+01		5.96E-06	4.75E-07	5.15E-10	NC	NC	NC	NI	NI	NI	0.00E+00	0.00
Zinc	7.54E+02		1.32E-04	1.05E-05	1.14E-08	NC	NC	NC	NI	NI	NI	0.00E+00	0.00
<b>PCBs</b>													
Aroclor 1254	6.76E-02		1.18E-08	1.32E-08	1.02E-12	2.00E+00	2.00E+00	2.00E+00	2.36E-08	2.64E-08	2.04E-12	5.00E-08	0.01
Aroclor 1260	2.88E-01		5.03E-08	5.62E-08	4.35E-12	2.00E+00	2.00E+00	2.00E+00	1.01E-07	1.12E-07	8.69E-12	2.13E-07	0.04
<b>Dioxins/Furans</b>													
TCDD Equivalents	3.57E-05		6.24E-12	1.49E-12	5.39E-16	1.50E+05	1.50E+05	1.50E+05	9.30E-07	2.24E-07	8.08E-11	1.16E-06	0.23
									Total Risk			5.1E-04	
Total Risk by Route									2.51E-04	2.60E-04	1.08E-07		

## Note:

- The EPC for each analyte was calculated by using the 95 percentile upper confidence level (UCL).
- Some metals have been screened out of the COPC list due to background concentrations exceeding maximum detected concentrations.
- It should be noted that no 2,3,7,8-TCDD was detected at the site. However, the detected dioxin and dibenzofuran concentrations are converted to a 2,3,7,8-TCDD equivalent concentration by convention, because a toxicity value only exists for 2,3,7,8-TCDD.

Table 9

## Noncarcinogenic Exposure and Health Risk Estimates (Maximum)

Medium: Surface Soil  
LandUse: Current

Receptor: Industrial Worker-Adult  
Exposure Pathway: Incidental Ingestion, Dermal Contac  
Inhalation of Fugitive Dust/Vapors

Operable Unit 1 - Former Disposal Area  
River Valley School  
Marion, Ohio

CHEMICAL OF POTENTIAL CONCERN	Maximum Concentration (mg/kg)	VF (Calculated)	Chronic Daily Intake Value			Reference Doses			Hazard Quotient			Hazard Index		
			Oral	mg/kg-day		Oral	mg/kg-day		Oral	mg/kg-day		Total	% of Total	
				Dermal	Inhalation		Dermal	Inhalation		Dermal	Inhalation			
VOLATILES														
Chloroform	1.34E-02	3228	6.56E-09	5.23E-09	8.12E-07	1.00E-02	1.00E-02	8.60E-05	6.56E-07	5.23E-07	9.45E-03	9.45E-03	0	
1,2-Dichloroethene (cis)	1.92E+00	3631	9.39E-07	7.50E-07	1.03E-04	1.00E-02	1.00E-02	NI	9.39E-05	7.50E-05	NI	1.69E-04	5	
1,2-Dichloroethene (trans)	2.26E-02	2265	1.11E-08	8.82E-09	1.95E-06	2.00E-02	2.00E-02	NI	5.53E-07	4.41E-07	NI	9.94E-07	0	
Methylene chloride	2.22E-01	2740	1.09E-07	8.67E-08	1.59E-05	6.00E-02	6.00E-02	8.57E-01	1.81E-06	1.44E-06	1.85E-05	2.18E-05	0	
Tetrachloroethene	1.45E-02	3435	7.09E-09	5.66E-09	8.26E-07	1.00E-02	1.00E-02	1.40E-01	7.09E-07	5.66E-07	5.90E-06	7.18E-06	0	
Toluene	2.10E-02	3866	1.03E-08	8.20E-09	1.06E-06	2.00E-01	2.00E-01	1.14E-01	5.14E-08	4.10E-08	9.30E-06	9.39E-06	0	
Trichloroethene	1.13E-01	2798	5.53E-08	4.41E-08	7.90E-06	6.00E-03	6.00E-03	NI	9.21E-06	7.35E-06	NI	1.66E-05	0	
1,2,4-Trimethylbenzene	3.10E-03	4510	1.52E-09	1.21E-09	1.35E-07	5.00E-02	5.00E-02	1.70E-03	3.03E-08	2.42E-08	7.91E-05	7.92E-05	0	
SVOCs														
Acenaphthene	2.16E+01		1.06E-05	1.10E-05	3.20E-09	6.00E-02	6.00E-02	NI	1.76E-04	1.83E-04	NI	3.59E-04	0	
Acenaphthylene	8.66E-01		4.24E-07	4.40E-07	1.28E-10	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Anthracene	5.55E+01		2.72E-05	2.82E-05	8.23E-09	3.00E-01	3.00E-01	NI	9.05E-05	9.39E-05	NI	1.84E-04	0	
Benzo(a)anthracene	1.61E+02		7.88E-05	8.17E-05	2.39E-08	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Benzo(a)pyrene	1.45E+02		7.09E-05	7.36E-05	2.15E-08	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Benzo(h)fluoranthene	1.03E+02		5.04E-05	5.23E-05	1.53E-08	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Benzo(g,h,i)perylene	3.35E+01		1.64E-05	1.70E-05	4.97E-09	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Benzo(k)fluoranthene	4.68E+01		2.29E-05	2.38E-05	6.94E-09	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Butylbenzophthalate	6.73E-01		3.29E-07	2.63E-07	9.98E-11	2.00E-01	2.00E-01	NI	1.65E-06	1.31E-06	NI	2.96E-06	0	
Carbazole	2.69E+01		1.32E-05	1.37E-05	3.99E-09	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Chrysene	1.90E+02		9.30E-05	9.64E-05	2.82E-08	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Dibenzofuran	1.14E+01		5.58E-06	5.79E-06	1.69E-09	4.00E-03	4.00E-03	NI	1.39E-03	1.45E-03	NI	2.84E-03	0	
Dibenz(a,h)anthracene	1.96E+01		9.59E-06	9.95E-06	2.91E-09	NI	NI	NI	NI	NI	NI	0.00E+00	1	
Di-n-octyl Phthalate	8.80E-02		4.31E-08	3.44E-08	1.30E-11	2.00E-02	2.00E-02	NI	2.15E-06	1.72E-06	NI	3.87E-06	0	
Fluoranthene	3.42E+02		1.67E-04	1.74E-04	5.07E-08	4.00E-02	4.00E-02	NI	4.18E-03	4.34E-03	NI	8.52E-03	0	
Fluorene	2.40E+01		1.17E-05	1.22E-05	3.56E-09	4.00E-02	4.00E-02	NI	2.94E-04	3.05E-04	NI	5.98E-04	4	
Indeno(1,2,3-cd)pyrene	4.17E+01		2.04E-05	2.12E-05	6.18E-09	NI	NI	NI	NI	NI	NI	0.00E+00	0	
2-Methylnaphthalene	2.17E+00		1.06E-06	1.10E-06	3.22E-10	2.00E-02	2.00E-02	NI	5.31E-05	5.51E-05	NI	1.08E-04	0	
Naphthalene	7.14E+00		3.49E-06	3.62E-06	1.06E-09	2.00E-02	2.00E-02	8.57E-04	1.75E-04	1.81E-04	1.23E-06	3.57E-04	0	
Phenanthrene	2.32E+02		1.14E-04	1.18E-04	3.44E-08	NI	NI	NI	NI	NI	NI	0.00E+00	0	
Phenol	1.58E-01		7.73E-08	6.17E-08	2.34E-11	6.00E-01	6.00E-01	NI	1.29E-07	1.03E-07	NI	2.32E-07	0	
Pyrene	3.42E+02		1.67E-04	1.74E-04	5.07E-08	3.00E-02	3.00E-02	NI	5.58E-03	5.79E-03	NI	1.14E-02	0	
bis(2-ethylhexyl)phthalate	1.51E+01		7.39E-06	5.90E-06	2.24E-09	2.00E-02	2.00E-02	NI	3.69E-04	2.95E-04	NI	6.64E-04	6	

Table 9

## Noncarcinogenic Exposure and Health Risk Estimates (Maximum)

Medium: Surface Soil  
Land Use: Current

Receptor: Industrial Worker-Adult  
Exposure Pathway: Incidental Ingestion, Dermal Contact  
Inhalation of Fugitive Dust/Vapors

Operable Unit 1 - Former Disposal Area  
River Valley School  
Marion, Ohio

CHEMICAL OF POTENTIAL CONCERN	Maximum Concentration (mg/kg)	VF (Calculated)	Chronic Daily Intake Value			Reference Doses			Hazard Quotient			Hazard Index	
			mg/kg-day			mg/kg-day						Total	% of Total
			Oral	Dermal	Inhalation	Oral	Dermal	Inhalation	Oral	Dermal	Inhalation		
<b>Metals</b>	0.00E+00												
Antimony	1.50E+01		7.34E-06	5.86E-07	2.22E-09	4.00E-04	6.00E-05	NI	1.83E-02	9.76E-03	NI	2.81E-02	0
Barium	1.94E+02		9.49E-05	7.57E-06	2.88E-08	7.00E-02	4.90E-03	1.40E-04	1.36E-03	1.55E-03	2.05E-04	3.11E-03	0
Beryllium	1.65E+00		8.07E-07	6.44E-08	2.45E-10	2.00E-03	1.40E-05	5.71E-06	4.04E-04	4.60E-03	4.78E-05	5.05E-03	2
Cadmium	1.74E+00		8.51E-07	6.79E-09	2.58E-10	1.00E-03	2.50E-05	5.70E-05	8.51E-04	2.72E-04	4.53E-06	1.13E-03	3
Chromium VI	7.76E+01		3.80E-05	3.03E-06	1.15E-08	3.00E-03	7.50E-05	2.86E-05	1.27E-02	4.04E-02	4.03E-04	5.35E-02	1
Cobalt	2.53E+01		1.24E-05	0.88E-07	3.75E-00	6.00E-07	6.00E-07	NI	2.06E-04	1.65E-05	NI	2.23E-04	27
Copper	3.93E+02		1.92E-04	1.53E-05	5.83E-08	3.70E-02	1.11E-02	NI	5.20E-03	1.38E-03	NI	6.58E-03	0
Lead	4.66E+02		2.28E-04	1.82E-05	6.91E-08	NI	NI	NI	NI	NI	NI	0.00E+00	3
Manganese	1.47E+03		7.19E-04	5.74E-05	2.18E-07	1.40E-01	5.60E-03	1.43E-05	5.14E-03	1.02E-02	1.53E-02	3.06E-02	0
Mercury	1.40E-01		6.85E-08	5.47E-09	2.08E-11	3.00E-04	3.00E-04	8.57E-05	2.28E-04	1.82E-05	2.42E-07	2.47E-04	16
Nickel	4.54E+01		2.22E-05	1.77E-06	6.73E-09	2.00E-02	8.00E-04	NI	1.11E-03	2.22E-03	NI	3.33E-03	0
Silver	2.70E+00		1.32E-06	1.05E-07	4.00E-10	5.00E-03	2.00E-04	NI	2.64E-04	5.27E-04	NI	7.91E-04	2
Vanadium	3.41E+01		1.67E-05	1.33E-06	5.06E-09	7.00E-03	1.82E-04	NI	2.38E-03	7.31E-03	NI	9.70E-03	0
Zinc	7.54E+02		3.69E-04	2.94E-05	1.12E-07	3.00E-01	3.00E-01	NI	1.23E-03	9.81E-05	NI	1.33E-03	5
<b>PCBs</b>													
Aroclor 1254	6.76E-02		3.31E-08	3.69E-08	1.00E-11	2.00E-05	2.00E-05	NI	1.65E-03	1.85E-03	NI	3.50E-03	0
Aroclor 1260	2.88E-01		1.41E-07	1.57E-07	4.77E-11	2.00E-05	2.00E-05	NI	7.05E-03	7.87E-03	NI	1.49E-02	2
<b>Dioxins/Furans</b>						NI	NI	NI					
TCDD Equivalent	3.57E-05		1.75E-11	4.18E-12	5.70E-15	NI	NI	NI	NI	NI	NI	0.00E+00	0

Total Hazard Index 2.0E-01

Total Hazard Index by Route 7.05E-02 1.01E-01 2.55E-02

## Note:

- The EPC for each analyte was calculated by using the 95 percentile upper confidence level (UCL).
- Some metals have been screened out of the COPC list due to background concentrations exceeding maximum detected concentrations.
- It should be noted that no 2,3,7,8-TCDD was detected at the site. However, the detected dioxin and dibenzofuran concentrations are converted to a 2,3,7,8-TCDD equivalent concentration by convention, because a toxicity value only exists for 2,3,7,8-TCDD.

AAG/RM/MWK

Table 1)

**Risk-Based Remediation Goals for the Commercial/Industrial Worker and Recreational User (Ballplayer)**  
Based on the Reasonable Maximum Exposure (RME) Scenario

**Operable Unit 1 - Former Disposal Area**  
**River Valley School**  
**Marion, Ohio**

Chemical of Potential Concern	Industrial Worker Non-Carcinogenic (mg/kg)	Industrial Worker Carcinogenic (ng/kg)	Industrial Worker Overall (mg/kg)	Ball Player Non-Carcinogenic (mg/kg)	Ball Player Carcinogenic (mg/kg)	Ball Player Overall (mg/kg)
<b>VOLATILES</b>						
Acetone	113,682	NC	113,682	59,853	NC	59,853
Benzene	26	1.5	1.5	37	8.4	8.4
sec-Butyl Benzene	11,368	NC	11,368	5,983	NC	5,983
Carbon disulfide	1,226	NC	1,226	1,734	NC	1,734
Carbon tetrachloride	6.0	0.55	0.55	8.5	3.2	3.2
Chlorobenzene	60	NC	60	806	NC	806
Chloroform	1.4	0.57	0.57	2.0	3.4	2.0
2-Butanone	20,472	NC	20,472	NA	NA	NA
1,2-Dichlorobenzene	3,558	NC	3,558	4,837	NC	4,837
1,3-Dichlorobenzene	1,023	NC	1,023	539	NC	539
1,4-Dichlorobenzene	11,102	8.6	8.6	10,221	46	46
1,1-Dichloroethene	10,231	0.12	0.12	5,387	0.70	0.70
1,2-Dichloroethene (cis)	11,368	NC	11,368	5,983	NC	5,983
1,2-Dichloroethene (trans)	22,736	NC	22,736	11,971	NC	11,971
Ethylbenzene	5,224	NC	6,124	8,193	NC	8,193
Isopropyl Benzene	5,526	NC	6,526	8,554	NC	8,554
4-Isopropyltoluene	NI	NC	NI	NC	NC	0.00
4-methyl-2-pentanone	2,159	NC	2,159	2,989	NC	2,989
Methylene chloride	10,205	23	23	11,675	124	124
Naphthalene	203	NC	203	289	NC	289
Tetrachloroethene	2,020	17.5	17.5	2,225	70	70
Toluene	2,236	NC	2,236	3,169	NC	3,169
1,1,2-Trichloroethane	4,547	2.1	2.1	2,394	11.6	11.6
Trichloroethene	5,821	6.5	6.5	3,591	38	38
1,2,4-Trimethylbenzene	39	NC	39	56	NC	56
1,3,5-Trimethylbenzene	39	NC	39	56	NC	56
Vinyl chloride	15.1	0.05	0.05	195	1.8	1.8
Total Xylenes	2,273,637	NC	2,273,637	1,197,054	NC	1,197,054
<b>SVOCs</b>						
Acenaphthene	60,194	NC	60,194	33,671	NC	33,671
Acenaphthylene	NI	NC	NI	NC	NC	0.00
Anthracene	300,972	NC	300,972	168,356	NC	168,356
Benzo(a)anthracene	NI	3.8	3.8	NC	9.0	9.0
Benzo(a)pyrene	NI	0.38	0.38	NC	0.90	0.90
Benzo(b)fluoranthene	NI	3.8	3.8	NC	9.0	9.0
Benzo(g,h,i)perylene	NI	NC	NI	NC	NC	NA
Benzo(k)fluoranthene	NI	38	38	NC	90	90
Butylbenzylphthalate	227,364	NC	227,364	119,705	NC	119,705
Carbazole	NI	140	140	NC	327	327
4-Chlorophenyl-phenylether	NI	NC	NI	NA	NA	0.00
Chrysene	NI	385	385	NC	897	897
Dibenzofuran	4,013	NC	4,013	2,245	NC	2,245
Dibenz(a,h)anthracene	NI	0.38	0.38	NC	0.90	0.90
1,2-Dichlorobenzene	3,558	NC	3,558	53,867	NC	53,867
1,4-Dichlorobenzene	11,102	8.6	8.6	10,221	NA	10,221
Di-n-butylphthalate	113,682	NC	113,682	59,853	NC	59,853
2,4-Dinitrotoluene	2,274	4.7	4.7	NA	NA	NA
Di-n-octyl Phthalate	22,736	NC	22,736	11,971	NC	11,971
Fluoranthene	40,130	NC	40,130	22,447	NC	22,447
Fluorene	40,130	NC	40,130	22,447	NC	22,447
Indeno(1,2,3-cd)pyrene	NI	3.8	3.8	NC	9.0	9.0
2-Methylnaphthalene	20,065	NC	20,065	11,224	NC	11,224
Naphthalene	203	NC	203	11,222	NC	11,222

Table 10

**Risk-Based Remediation Goals for the Commercial/Industrial Worker and Recreational User (Ballplayer)**  
Based on the Reasonable Maximum Exposure (RME) Scenario

**Operable Unit 1 - Former Disposal Area**  
**River Valley School**  
**Marion, Ohio**

Chemical of Potential Concern	Industrial Worker Non-Carcinogenic (mg/kg)	Industrial Worker Carcinogenic (mg/kg)	Industrial Worker Overall (mg/kg)	Ball Player Non-Carcinogenic (mg/kg)	Ball Player Carcinogenic (mg/kg)	Ball Player Overall (mg/kg)
N-nitroso-di-n-propylamine	NI	0.45	0.45	NA	NA	NI
Phenanthrene	NI	NC	NI	NC	NC	NI
Phenol	682,091	NC	682,091	359,116	NC	359,116
Pyrene	30,097	NC	30,097	16,835	NC	16,836
bis(2-ethylhexyl)phthalate	22,736	227	227	11,971	499	499
<b>Metals</b>						
Aluminum	1,084,699	NC	1,084,699	593,425	NC	593,425
Antimony	534	NC	534	259	NC	259
Arsenic	495	3.1	31	213	5.5	5.5
Barium	65,537	NC	65,537	38,111	NC	38,111
Beryllium	329	7,886	329	303	96,692	303
Cadmium	1,548	0.515	1,548	690	128,922	690
Chromium VI	1,460	1,616	1,460	1,078	19,810	1,078
Cobalt	113,577	NC	113,577	44,868	NC	44,868
Copper	59,738	NC	59,738	25,988	NC	25,988
Iron	0.00	NC	0.00	193,893	NC	193,893
Lead	NI	NC	NI	NC	NC	0.00
Manganese	74,489	NC	74,489	59,137	NC	59,137
Mercury	568	NC	568	224	NC	224
Nickel	13,649	NC	13,649	8,982	NC	8,982
Selenium	9,465	NC	9,465	3,739	NC	3,739
Silver	3,412	NC	3,412	2,246	NC	2,246
Vanadium	1,516	NC	3,316	2,568	NC	2,568
Zinc	567,883	NC	567,883	224,338	NC	224,338
<b>PCBs</b>						
Aroclor 1254	19.3	1.4	1.4	11.0	3.2	3.2
Aroclor 1260	19.3	1.4	1.4	11.0	3.2	3.2
<b>Dioxins/Furans</b>						
TCDD Equivalents	NI	0.00003	0.00003	NC	0.00006	0.00006